93d Congress
1st Session

COMMITTEE PRINT

WATERSHED WORK PLAN FOR CLARKS FORK-BULLOCKS CREEK WATERSHED, YORK COUNTY, SOUTH CAROLINA AND CLEVELAND COUNTY, NORTH CAROLINA

REPORT OF THE SOIL CONSERVATION SERVICE, DEPARTMENT OF AGRICULTURE, IN ACCORDANCE WITH THE PROVISIONS OF PUBLIC LAW 83-566

COMMITTEE ON PUBLIC WORKS

UNITED STATES SENATE

APRIL 1973

SERIAL NO. 93-4

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PRELIMINARY CONTENTS

LETTER OF TRANSMITTAL

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 13, 1973

Honorable Spiro T. Agnew
President of the Senate
Washington, D. C.

Dear Mr. President:

Pursuant to the authority vested in the President by section 5 of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. 1005), and delegated to the Director of the Office of Management and Budget by Executive Order No. 10654 of January 20, 1956, there are transmitted herewith the following plans for works of improvement which have been prepared under the provisions of that Act.

State	Watershed
Colorado and Wyoming	Boxelder Creek [1]
Indiana and Ohio	East Fork of Whitewater River [2]
Nebraska	Winters Creek [3]
South Carolina and North Carolina	Clarks Fork-Bullocks Creek

Each of the above listed plans involves at least one structure which provides more than 4,000 acre-feet of total capacity.

Sincerely,

Fred Malek

FREDERIC V. MALEK, *Acting Director.*

[1] See committee print No. 93-3.
[2] See committee print No. 93-5.
[3] See committee print No. 93-6.

USDA ENVIRONMENTAL STATEMENT
Clarks Fork-Bullocks Creek Watershed, South Carolina

Prepared in Accordance with Sec. 102(2)(C) of P.L. 91-190

Summary Sheet

I. Draft ( ) Final (X)

II. Soil Conservation Service

III. Administrative (X) Legislative ( )

IV. Description of Action:

A watershed project to be carried out by sponsoring local organizations with federal assistance under authority of PL-566. The project, located in York County, proposes conservation land treatment over the watershed, supplemented by six floodwater retarding structures, one multiple purpose structure for flood prevention and recreation, and 360 acres of critical area treatment.

V. Summary of Environmental Impact and Adverse Environmental Effects:

The project will: reduce erosion and sedimentation; reduce floodwater damages on 3,355 acres by 87 percent; benefit 100 farms; provide new wildlife habitat; create a 650 acre recreation lake and related facilities for an expected 230,000 visitor days annually; create 394 acres of lake fishery at the six floodwater retarding structures with an estimated 29,550 visitor days annually; create additional local employment opportunities; eliminate agricultural and wildlife use on 1,044 acres; periodically interrupt agricultural and wildlife use in the 1,110 acres for detention pools; eliminate agricultural and wildlife use of 117 acres in dams and spillways until these areas are revegetated; inundate 15 miles of stream channels; and increase vehicular traffic in the recreation area.

VI. List of Alternatives Considered:

A. Conservation land treatment alone
B. Less intensive use of the flood plain
C. Alternate combination of floodwater retarding structures
D. Channel improvement to supplement the floodwater retarding structures
E. Other locations for the recreation development area.

VII. Agencies from which Comments have been Received:

U.S. Department of the Army
U.S. Department of the Interior
U.S. Department of Health, Education and Welfare
Environmental Protection Agency
S.C. Water Resources Commission (for the Governor of South Carolina)
S.C. State Planning and Grants Division (Clearinghouse)

VIII. The Environmental Statements were made Available to the Council on Environmental Quality and the Public on:

Draft Environmental Statement - November 2, 1971
Final Environmental Statement -

USDA SOIL CONSERVATION SERVICE ENVIRONMENTAL STATEMENT

Type of Statement: Draft ( ) Final (X)

Date: April 1972

Type of Action: Administrative (X) Legislative ( )

Title of Statement: Clarks Fork-Bullocks Creek Watershed, South Carolina

1. Description

Authority for Project: Federal assistance through Public Law 566, 83rd Congress, 68 Stat. 666, as amended.

Sponsoring Local Organizations: York Soil and Water Conservation District, Clarks Fork-Bullocks Creek Watershed Conservation District, and the South Carolina Department of Parks, Recreation and Tourism.

Project Measures: The project proposes 17,600 acres of conservation land treatment measures,360 acres of critical area stabilization, six floodwater retarding structures, one multiple purpose structure for flood prevention and recreation, and recreational facilities. See attached Project Map.

Environmental Setting:

The watershed is located in north-central South Carolina in York County. About two percent of the watershed extends into Cleveland County, North Carolina. The total watershed area is 77,500 acres. There are 1,880 acres owned by the U.S. Department of Interior, in the Kings Mountain National Military Park and 5,070 acres owned by the South Carolina Department of Parks, Recreation and Tourism in the Kings Mountain State Park. The land use in the watershed is as follows: cropland - 8,500 acres (11%); grassland - 15,500 acres (20%); woodland - 50,400 acres (65%); and other land - 3,100 acres (4%). A total of 3,355 acres are subject to flooding. The present use of the flood plain is as follows: corn - 225 acres (7%); soybeans - 265 acres (8%); pasture - 1,065 acres (32%); and woods - 1,800 acres (53%). The average value of the upland in the watershed is $325 per acre. Flood plain values range from $75 to $500 per acre.

The population of the watershed is about 4,000, most of which is rural. Income is mainly derived from agriculture and employment in several surrounding industrial and trading centers. Major agricultural enterprises are livestock, forest products, grains, soybeans, peaches, and poultry. Most of the 340 farms are low income family farms. More than half produce annual sales of less than $2,500. The farms average

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about 200 acres in size. A few of the farm operators hire full time labor. Textile and other manufacturing firms in adjoining towns provide employment for a large number of local residents, but many are underemployed.

Landowners on 200 farms have received assistance with soil and water conservation plans. These plans cover 40,800 acres, or about 53 percent of the watershed.

Kyanite, granite and pyrite are mined in York County, South Carolina, and spodumene, a lithium mineral, is mined in the watershed area of Cleveland County, North Carolina. Since construction of structural measures will not encroach upon active mining operations, the mining and mineral resources of the area will not be affected by this project.

Most of the fishing resource is supplied by farm ponds. These are stocked with bass, bluegill, and channel catfish. Streams support a sucker-type fishery and fishing pressure on them is light. All of the major tributaries in the watershed have a strong base flow and have gone dry only on very rare occasions. All of the streams are natural streams, although some have been improved in the past by the removal of sediment and debris. Wildlife habitat consists of woodland interspersed with agricultural land. Part of the watershed is within a game management public hunt unit administered by the South Carolina Wildlife Resources Department. Deer and wild turkey have been reestablished in this area and are currently providing outdoor recreation in the form of hunting. The watershed has good populations of quail, rabbit, squirrel, dove, raccoon, and opossum. Its value as natural waterfowl habitat is low. Some ducks use the farm ponds and streams during migration.

There is a need for increasing the recreation opportunities in Kings Mountain State Park. This park is the primary recreation attraction in the area and additional recreation facilities are needed to relieve present overcrowding and to meet future demands. The recently completed State Comprehensive Outdoor Recreation Plan by the South Carolina Department of Parks, Recreation and Tourism has indicated that Kings Mountain State Park should be enlarged to meet their criteria as a major State Park.

Flood damage occurs to 3,355 acres of flood plain land. A three-year frequency storm floods about 2,800 acres. Some areas flood as often as five times a year. The estimated total average annual flooding damage is $50,400. Of this, $32,300 is to crops and pasture and $13,700 to other agricultural property. The remainder is non-agricultural damage, such as damage to roads and bridges. Erosion has been very severe in the past, but is not as serious at present. Sediment damage is severe in some areas. The estimated average annual sediment

delivered at the outlet is 21,600 tons. The average annual sediment damage is $22,000.

Project measures include a total of 17,600 acres of conservation land treatment measures. Cropland will have 2,500 acres treated and grassland 6,500 acres. Reforestation of appropriate open land and understocked stands is planned for 1,050 acres. Stand improvement will be carried out on about 6,750 acres. Approximately 360 acres of critically eroding land need treatment.

There will be six floodwater retarding structures and one multiple purpose structure for flood prevention and recreation with facilities. The recreation area will consist of a 650 acre lake, picnicking, fishing, boating, family camp and primitive camp areas, and sanitary facilities meeting state and local health requirements. The streams of the watershed have been classified "A", which will meet requirements for the intended usage. The recreation area will become a part of Kings Mountain State Park and will be managed accordingly. The project will be coordinated with the adjoining National Military Park to insure proper management of solid waste generated by increased usage of this park. It is anticipated that the pool areas of the six single purpose structures will be made available to the general public and organized groups for incidental use. In this event, the sponsors will inform the landowners of the need for adequate sanitary facilities to comply with requirements of the South Carolina State Board of Health. Where sanitary facilities are not provided, the sponsors will discourage use of the pools.

The total installation cost of the project is estimated to be $4,111,400.

Land use in the areas affected by the structures is shown in the following table:

Present Land Use	Commitment of Land to Project Measures			
	Recreation Area	Flood Storage Area	Pool Area	Dam and Spillway Area
(Acres)	(Acres)			
Woodland - 2,504	779	858	773	94
Grassland - 401	-	213	168	20
Cropland - 80	-	39	38	3
Water - 65	-	-	65	-
TOTAL - 3,050	779	1,110	1,044	117

Special design features, such as debris basins and temporary vegetation, will be incorporated during construction to control erosion and downstream sedimentation damage. Contractors will adhere to strict guidelines for minimizing soil erosion and water and air pollution during construction. All areas left exposed after construction will be planted to appropriate, permanent vegetation to control erosion.

The National Register of Historic Places lists only one site which is located within the watershed. This site is the Kings Mountain National Military Park, northwest of Bethany on South Carolina Highway 161. There are no known historical or archeological features of national significance within the proposed construction or impoundment areas. Prior to construction, the Secretary of the U.S. Department of Interior will be notified as required by Public Law 86-523. Copies of the work plan draft have been sent to the South Carolina State Archives Department; the Institute of Archeology and Anthropology, University of South Carolina; and to the Regional Director of the National Park Service.

2. Environmental Impact

The project will reduce erosion and sediment production by about 77 percent. Overbank sediment deposition will be decreased by 81 percent, and swamping by 93 percent. The average annual acres flooded, including repetitive flooding will be reduced from 6,900 to 1,150. Average annual flood damages will be reduced from $79,400 to $10,000. These benefits will accrue to about 100 families, allowing them to improve their standard of living.

The water quality in the streams will be improved by increasing the low stream flow. This will be caused by an increase in the water table in the vicinity of the structures and the normal drainage of the pools through the embankment and foundation drainage systems. During periods of low stream flow, at least as much water as enters the reservoirs will be released to provide for downstream uses and to maintain a beneficial equilibrium of biological organisms.

The proposed project will reduce total sediment yield to the watershed outlet by 77 percent. The average sediment concentration of waters in channels below the structures will be reduced from an estimated 130 ppm to 30 ppm. The result of this decreased sediment load will be that presently clogged channels will slowly cleanse themselves. This cleansing action will remove silt and other sediment which has filled the spaces between gravel and stones and thereby improve the habitat for many aquatic insects and invertebrate animals such as mollusks and crayfish. With this improved habitat, these small organisms upon which fish prey will be better able to survive and thereby improve the fish resource.

Wildlife habitat will be increased by the development and management of 500 acres for wildlife food and cover, most of which is on privately owned land along edges of cultivated fields. Land treatment measures, critical area stabilization, and multiple-use timber management will also improve the wildlife habitat. Reduced sedimentation on the bottom lands will result in better soil development and improved forage and cover.

Structure 12 will provide a 650 acre recreation lake and recreation facilities for picnicking, camping, boating, fishing, and hiking. About 230,000 visitor days annually are expected. These visitors will also be attracted to the existing State Park and the adjoining Kings Mountain National Military Park. As an incidental effect, the sediment pools of the six floodwater retarding structures will provide 394 acres for fishing and other recreational activities at the rate of 29,550 visitor days annually. Prior to making the pools available, sanitary facilities will be installed in accordance with state health laws.

Evaporation and seepage losses from the reservoirs will not be significant. About 15 miles of sucker-type stream fishery will be inundated by the recreation pool and sediment pools. The planned water areas will destroy agricultural use and wildlife habitat on 773 acres of woodland, 168 acres of grassland, and 38 acres of cropland. Periodic inundation of the flood detention pools will interrupt agricultural and wildlife use on 858 acres of woodland, 213 acres of grassland, and 39 acres of cropland. Construction of the dams and spillways will eliminate agricultural and wildlife use on 94 acres of woodland, 20 acres of grassland, and three acres of cropland, until these areas are revegetated immediately after construction. At Structure 12, the detention pool and the additional 779 acres of land planned for recreation will be used for picnicking, camping, boating, fishing, hiking, and other recreational activities. This area is expected to remain primarily in woods.

There will be no significant adverse effect on the long range ambient air quality; however, there may be a short term adverse effect since vegetation from land clearing and construction waste materials will be disposed of on the site by open burning and/or burying in accordance with applicable state air pollution and solid waste regulations.

The economy of the area will be improved by greater agricultural efficiency and a decrease in underemployment. This will make it possible for farmers to stay in business and not migrate to the city.

Direct primary benefits and operation and maintenance of the project measures will result in the creation of 50 permanent jobs for local residents. In addition, 95 man-years of labor will be performed by local residents during construction. The expanded economic base and preservation of the rural area will enhance the quality of human life, improve the population distribution, and encourage the local residents in overall rural development.

Secondary impacts of the project include increased business activity in the area, increased income from transporting, processing and marketing of goods and services, and increased vehicular traffic in the recreation area and around the sediment pools. The secondary impact will result in the creation of 90 new jobs.

The average annual cost of the structural measures is estimated to be $217,600. This cost, when compared to the estimated average annual benefits of $535,000, results in a benefit-cost ratio of 2.5 to 1. (See attached Table 6 from the work plan.)

3. Favorable Environmental Effects

a. Reduces erosion and sediment production by about 77 percent.

b. Reduces the damages caused by overbank sediment deposition and swamping by about 81 and 93 percent, respectively.

c. Reduces the average annual area flooded from 6,900 acres to 1,150 acres, and the monetary damages from $79,400 to $10,000.

d. About 100 familes will be directly benefited by reduced flooding.

e. Improve water quality by increasing low flow and improving the stream fishery resource.

f. Improves wildlife habitat.

g. Increases recreation opportunities.

h. Creates 1,044 acres of pools. Available for fishing.

i. Improves economy of the area.

4. Adverse Environmental Effects Which Cannot Be Avoided

a. The dams, spillways, and impoundments will eliminate 867 acres of woods, 188 acres of grassland, and 41 acres of cropland.

b. About 15 miles of stream fishery will be eliminated by the impoundments.

c. Possible short term reduction of ambient air quality.

d. Increase vehicular traffic.

5. Alternatives

Among the possible uses of the flood plain are the following: (1) non-agricultural, including residential, (2) less intensive uses, such as retiring cropland and pasture to woodland, and (3) continuation of the present pattern of agricultural use.

Due to the location of the watershed, there is very little possibility of non-agricultural use of the flood plain.

An alternative to the proposed project would be to convert all the flood plain to woodland. This would eliminate most of the damage potential from floodwater, however, flood plain erosion and sedimentation would continue. In addition, such a land use conversion would not fit into the economic enterprises to which the landowners are committed nor would it permit the flood plain areas to be used in accordance with their capability.

The continuation of the present pattern of flood plain use is in harmony with the desires of the landowners and the local sponsors. For the present and future intensity of use, agreement was reached between the sponsors and the Soil Conservation Service on an objective that would protect most of the flood plain from a three-year frequency flood.

To accomplish flood control objectives, consideration was given to agricultural needs and trends. Several alternate systems of structures were analyzed. Individual structures on Clarks Fork and on Bullocks Creek, just above their confluence, were considered as an alternate. It was determined that the same degree of flood protection could be obtained at less cost by using just the one structure planned at their confluence. All the structures are planned to provide protection for those areas having intensive use.

Channel improvement was considered as a supplement to the various combinations of structures studied. Although the channel improvement could have provided protection for the entire flood plain for a one-year frequency storm, it was determined that a sufficient level of protection could be obtained without stream channel improvement.

Planned land treatment without structural measures would not provide adequate flood protection. However, it would provide some flood damage reduction benefits of $4,700 annually, or about seven percent of what the structures would provide.

An alternative to the proposed recreation development would be a new park in another location. This would increase the cost of adequate management and control of the recreation area. Other proposed sites for lakes in the area have less potential than the one proposed. The recreation area proposed will be incorporated into the existing State Park making one efficient manageable unit.

If the project is not installed, erosion, sediment, and flooding damages would continue and Kings Mountain State Park would continue to be overcrowded. The net monetary benefits lost by not implementing the project would be an estimated $317,400 yearly.

6. Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The watershed is in a rural, small town setting. It is expected that a rural environment will continue, with agriculture and timber as its basic resources. The majority of the land used for the dams, spillways, normal pools, recreation lake and the recreation facility area is woodland. Current productivity will be maintained and improved. The expected future land use in the watershed is as follows: cropland - 6,200 acres (8%); grassland - 17,100 acres (22%); woodland - 48,800 acres (63%); and other land - 5,400 acres (7%). After 100 years, the project will still provide benefits through the conservation of land and water resources of the watershed. The project will continue to reduce erosion, sediment and flooding, and will provide recreation and economic opportunities.

7. Irreversible and Irretrievable Commitments of Resources

The project will commit about 3,050 acres, 82 percent of which is woodland, to the following non-agricultural uses: (1) 1,044 acres in pool areas, (2) 779 acres for recreational facilities, (3) 1,100 acres in flood pools, (4) 117 acres in dams and emergency spillways, and (5) 15 miles of stream channels. No other permanent commitment

of resource is known to be required for this project.

8. Consultation With Appropriate Federal Agencies and Review by State and Local Agencies Developing and Enforcing Environmental Standards

a. General

The project has been coordinated with all interested agencies throughout the application and planning stages. State agencies and field offices of federal agencies were notified when planning authorization was obtained and were kept informed as project formulation progressed. The U.S. Forest Service and the U.S. Fish and Wildlife Service in consultation with their state counterparts, made written contributions to the work plan.

One alternative considered during the planning phase included less control by flood retarding structures in conjunction with ten miles of stream channel improvement. The U.S. Fish and Wildlife Service recommended that flood control be obtained by structures only, in lieu of stream channelization. After detail study, it was determined that this alternative would meet the objectives of the sponsors and it is therefore, the one proposed for this project.

Several informational meetings were held to keep the general public informed. All interested agencies were furnished a preliminary draft of the work plan and asked for their comment. These comments have been incorporated in the work plan. At the informal field review held on May 12, 1971, there were no adverse comments presented.

b. Consultation With Federal Agencies

The U.S. Fish and Wildlife Service and the U.S. Forest Service made written contributions to the work plan.

The following federal agencies were invited to comment on the Draft Environmental Statement. The comments and disposition for each is as follows:

U.S. Department of the Army:

This Department foresees no conflict with any of their projects or current proposals in this work plan. They also concur with the Draft Environmental Statement.

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U.S. Department of the Interior:

This Department made comments on the Environmental Statement under four headings.

Fish and Wildlife - It was stated that the Environmental Statement is generally adequate with respect to assessing the project's impact on the fish and wildlife resources. They suggest the "Summary" and the "Irretrievable Resources" sections reflect the statement, "Although the values are not high, the intensification of land use will result in a net loss of wildlife and wildlife habitat". This has not been done. One of the land uses to be intensified is wildlife habitat development. While installing this land treatment measure is a voluntary action of the landowner, so are the actions for intensification of land uses for other purposes.

Geology - An addition has been made to the Environmental Statement on Page 2.

Alternatives - It was suggested that one alternative should be to consider construction of the Greater Lockhart project and modify the watershed work plan. The Greater Lockhart project would be for a different need. It is located on the Broad River below Clarks Fork-Bullocks Creek Watershed. As indicated in the work plan, decisions were made considering Greater Lockhart project in consultation with the Corps of Engineers. The watershed project will not increase the cost to develop Greater Lockhart site and has been evaluated anticipating its construction at a later date.

A comment was made that the "no action" alternative is not discussed. Alternatives A and B, as listed in the Summary, are alternatives of no project action.

It was suggested that this section would be improved if other alternatives were developed to avoid the major adverse environmental effects of the recommended plan, the preservation of the recreation or fish and wildlife resource base. No change has been made. During the planning of this project, the Bureau of Sport Fisheries and Wildlife, in cooperation with the South Carolina Wildlife Resources Department and the North Carolina Wildlife Resources Commission made a study and a report dated February 10, 1970. No serious adverse effects were mentioned if the alternative they recommended was accepted. All of their recommendations in this report were incorporated in the final plan, except the one to provide public fishing and hunting access to the floodwater retarding structures.

Historical Preservation - An addition has been made to the Environmental Statement on Page 4.

U.S. Department of Health, Education and Welfare:

This Department stated that the development of the recreation lake with facilities does not represent any threat to public health.

Environmental Protection Agency:

This Agency points out that disposal of land clearing waste, construction debris, and demolition debris could present short term adverse environmental impacts unless disposed of in accordance with state air pollution and solid waste regulations. They foresee no significant adverse effect on the long-range ambient air quality. They stress that all solid waste disposal should be done in accordance with state regulations. The Environmental Statement has been revised to reflect these suggestions.

The Agency stated that the population influx and increased economic and recreational activities due to and associated with construction will likely overload solid waste facilities. The Statement has been modified to show that waste materials will be disposed of properly on the site.

The Agency stated that plans for the management of solid waste generated on federal land by this project should be coordinated with and meet the requirements stipulated by the federal agency responsible for the land. The Environmental Statement has been modified to reflect this suggestion.

The Agency suggested that the Environmental Statement be modified by stating that during periods of low stream flow, at least as much water as enters the reservoirs will be released to provide for downstream uses and to maintain a beneficial equilibrium of biological organisms. This modification has been made in the Environmental Statement.

The Agency stated that the Environmental Impact Statement does not state the stream use classification in the watershed and whether or not the quality of the impounded water in the multiple purpose structure is expected to comply with the National Advisory Committee water quality criteria for primary contact recreation. The Environmental Statement has been modified to state that the streams of the watershed are classified "A", which meet requirements for the intended usage.

Federal Power Commission:

Did not respond.

c. Consultation and Review With State and Local Agencies

The South Carolina State Commission of Forestry and the South Carolina Wildlife Resources Department contributed to the planning of the project. All interested agencies were furnished a preliminary draft of the work plan and asked for comment. All of these agencies concurred in the work plan draft as written.

The following state and local agencies were invited to comment on the Draft Environmental Statement:

The Water Resources Commission (for the Governor of South Carolina):

The Commission stated that the elimination of streams by inundation is not necessarily an adverse environmental impact in all cases, depending upon the value of the stream as a fishery before inundation. No change in the Environmental Statement was made since the 15 miles of stream fishery as cited was described as supporting a sucker-type fishery by the U.S. Fish and Wildlife Service.

The Commission suggested moving the first paragraph of item 5 to become the last paragraph of item 5. This change was not made since it would alter the continuity of this section.

The South Carolina State Planning and Grants Division (Clearinghouse):

The State Clearinghouse concurred with the comments of the South Carolina Water Resources Commission.

Central Piedmont Regional Planning Commission:

Did not respond.

APPROVED BY: Kenneth E. Hart Date: JUN 1 1972
Administrator

SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. 1

between the

York Soil and Water Conservation District
Clarks Fork-Bullocks Creek Watershed Conservation District
South Carolina Department of Parks, Recreation and Tourism

State of South Carolina
(hereinafter referred to as the Sponsoring Local Organizations)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, the Watershed Work Plan Agreement for Clarks Fork-Bullocks Creek Watershed, State of South Carolina, executed by the Sponsoring Local Organizations named therein; and

Whereas, in order to carry out the watershed work plan for said watershed, it has become necessary to modify said Watershed Work Plan Agreement;

Now, therefore, the Sponsoring Local Organizations and the Service hereby agree upon the following modifications of the terms, conditions, and stipulations of said Watershed Work Plan Agreement:

A new paragraph, numbered 16, is added as follows:

16. The Sponsoring Local Organizations will provide relocation advisory assistance services and make the relocation payments to displaced persons as required by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. Prior to July 1, 1972, the Sponsoring Local Organizations will comply with the real property acquisition policies contained in said Act and Regulations to the extent that they are legally able to do so in accordance with their State law. After July 1, 1972, the real property acquisition policies contained in said Act shall be followed in all cases.

The Service will bear 100 percent of the first $25,000 of relocation payment costs for any person, business, or farm operation displaced prior to July 1, 1972. Any such costs for a single dislocation in excess of $25,000 and all costs for relocation payments for persons displaced after July 1, 1972, will be shared by the Sponsoring Local Organizations and the Service as follows:

	Sponsoring Local Organizations (percent)	Service (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	45.9	54.1	0

Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

YORK SOIL AND WATER CONSERVATION DISTRICT

By _____
Chairman

Address: Route 6 Box 178A, Rock Hill, South Carolina 29730

Date 9-10-71

The signing of this agreement was authorized by a resolution of the governing body of the York Soil and Water Conservation District adopted at a meeting held on 9-10-71.
Date

_____
Secretary

Date 9-10-71

CLARKS FORK-BULLOCKS CREEK WATERSHED CONSERVATION DISTRICT

By _____
Chairman

Address: Route 1, Smyrna, South Carolina 29743

Date 9-10-71

The signing of this agreement was authorized by a resolution of the governing body of the Clarks Fork-Bullocks Creek Watershed Conservation District adopted at a meeting held on 5-12-71.
Date

_____
Secretary

Date 9-10-71

SOUTH CAROLINA DEPARTMENT OF PARKS, RECREATION AND TOURISM

By Dwight A Hooker
Chairman, PRT Commission

Address: P.O. Box 247, Pickens, South Carolina 29671

Date September 24, 1971

The signing of this agreement was authorized by a resolution of the governing body of the South Carolina Department of Parks, Recreation and Tourism adopted at a meeting held on January 29, 1971.
Date

By Bob Hinton
Executive Director

Date September 24, 1971

SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

By Kenneth E Grant
Administrator

Date JUN 28 1972

WATERSHED WORK PLAN AGREEMENT

between the

York Soil and Water Conservation District
Clarks Fork-Bullocks Creek Watershed Conservation District
South Carolina Department of Parks, Recreation and Tourism

State of South Carolina
(hereinafter referred to as the Sponsoring Local Organizations)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Clarks Fork-Bullocks Creek Watershed, State of South Carolina under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for the Clarks Fork-Bullocks Creek Watershed, State of South Carolina, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about eight years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

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1. Except as hereinafter provided, the Sponsoring Local Organizations will acquire without cost to the Federal Government such land rights as will be needed in connection with the works of improvement. (Estimated cost - $747,500.) The percentages of this cost to be borne by the Sponsoring Local Organizations and the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (percent)	Service (percent)	Estimated Land Rights Costs (dollars)
Multiple Purpose Structure 12 and Recreational Facilities			
Payments to landowners for about 550 acres	50	50	110,000
Value of about 1,470 acres presently owned by S.C. Department of Parks, Recreation and Tourism	100	0	294,000
Legal fees, survey costs, and flowage easements	100	0	3,500
Six Floodwater Retarding Structures	100	0	340,000

The South Carolina Department of Parks, Recreation and Tourism agrees that all land acquired or improved with PL-566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project, except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The Sponsoring Local Organizations will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organizations and by the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (percent)	Service (percent)	Estimated Construction Cost (dollars)
Multiple Purpose Structure 12			
Joint Costs:	37.4	62.6	652,000
Recreational Facilities	50	50	640,000
Six Floodwater Retarding Structures	0	100	893,700

4. The percentages of the engineering costs to be borne by the Sponsoring Local Organizations and the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (percent)	Service (percent)	Estimated Engineering Costs (dollars)
Multiple Purpose Structure 12			
Joint Costs:	0	100	30,000
A&E Contract for Recreational Facilities	50	50	28,600
Six Floodwater Retarding Structures	0	100	76,200

5. The Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be $50,000 and $262,900, respectively.

6. The York Soil and Water Conservation District will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

7. The York Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. Cost sharing for critical area stabilization is agreed to by increments of work as follows:

Treatment	PL-566	Other
170 acres of Grasses and Legumes		
(a) Gullies and Borrow Pits	Furnish materials and establish vegetation.	Construct or relocate fences, slope banks, construct dikes, diversions, or gully plugs as necessary.
(b) Other	Furnish materials.	Prepare seedbeds, apply lime and fertilizer, plant seeds or plants, apply mulch and construct or relocate fences as necessary.
190 acres of Trees	Prepare sites and plant trees.	Provide seedlings, needed mulch material, and construct or relocate fences where necessary.

9. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The Sponsoring Local Organizations will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

    A separate agreement will be entered into between the Service and the Sponsoring Local Organizations before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. Sec. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

YORK SOIL AND WATER CONSERVATION DISTRICT

By _____
Chairman

Address: Route 6 Box 178A, Rock Hill, South Carolina 29730

Date May 17 1971

The signing of this agreement was authorized by a resolution of the governing body of the York Soil and Water Conservation District adopted at a meeting held on April 19, 1971.

_____
Acting Secretary

Date May 12, 1971

CLARKS FORK-BULLOCKS CREEK WATERSHED CONSERVATION DISTRICT

By _____
Chairman

Address: Route 1, Smyrna, South Carolina 29743

Date May 12, 1971

The signing of this agreement was authorized by a resolution of the governing body of the Clarks Fork-Bullocks Creek Watershed Conservation District adopted at a meeting held on April 9, 1971.

_____
Secretary

Date 12 May 71

SOUTH CAROLINA DEPARTMENT OF PARKS, RECREATION AND TOURISM

By Wright A Holder
Chairman, PRT Commission

Address: P.O. Box 247, Pickens, South Carolina 29671

Date March 16 1971

The signing of this agreement was authorized by a resolution of the governing body of the South Carolina Department of Parks, Recreation and Tourism adopted at a meeting held on January 29, 1971.

By [signature]
Executive Director

Date March 16, 1971

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

By Kenneth E Grant
Administrator

Date JUN 28 1972

WATERSHED WORK PLAN FOR CLARKS FORK-BULLOCKS CREEK WATERSHED, YORK COUNTY, SOUTH CAROLINA AND CLEVELAND COUNTY, NORTH CAROLINA

94-840 O-73——5

WATERSHED WORK PLAN

CLARKS FORK-BULLOCKS CREEK WATERSHED
York County, South Carolina and Cleveland County, North Carolina

Prepared under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended

Prepared by: York Soil and Water Conservation District
Clarks Fork-Bullocks Creek Watershed Conservation District
South Carolina Department of Parks, Recreation and Tourism

With Assistance by:

U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Agriculture, Forest Service

AUGUST 1970

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SUMMARY OF PLAN

Clarks Fork-Bullocks Creek Watershed, consisting of 77,500 acres, is located in York County, South Carolina, and Cleveland County, North Carolina. The watershed is in the Southern Piedmont Land Resource Area.

Sponsors of the plan are the York Soil and Water Conservation District, the Clarks Fork-Bullocks Creek Watershed Conservation District, and the South Carolina Department of Parks, Recreation and Tourism.

The major problems in this watershed are flood damage to 3,355 acres of fertile flood plain land and overcrowding of recreational facilities. Farmers have been forced to reduce acreages of high producing row crops because of flooding.

Project measures include 17,600 acres of conservation measures, 360 acres of critical area stabilization, six floodwater retarding structures, one multiple purpose structure for flood prevention and recreation, and recreational facilities. These measures will reduce average annual flood damages by 87 percent. An estimated 230,000 visitor days of recreation will be provided annually.

Estimated total project installation costs of $4,111,400 will be shared as follows:

	PL-566 Funds	Other Funds	Total
Land treatment (including critical areas and accelerated technical assistance)	$ 164,000	$ 566,500	$ 730,500
Recreation	655,600	930,000	1,585,600
Flood Prevention	1,141,800	340,600	1,482,400
Project Administration	262,900	50,000	312,900
Total Cost	$2,224,300	$1,887,100	$4,111,400

Needed land treatment measures will be installed by landowners in accordance with conservation plans made with the York Soil and Water Conservation District. Technical assistance in the planning and application of these measures will be provided by the Soil Conservation Service. Technical assistance for applying planned forestry measures will be furnished by the U.S. Forest Service in cooperation with and through the South Carolina State Commission of Forestry. Critical area treatment will be done by landowners or by contract.

Project measures will be installed during an eight year installation period. The South Carolina Department of Parks, Recreation and Tourism will operate and maintain Structure 12 and the associated recreational facilities. The Clarks Fork-Bullocks Creek Watershed Conservation District will operate and maintain all other structural measures. The estimated average annual cost of operation and maintenance is $43,200.

The average annual benefits from the planned measures are $535,000 and the average annual cost is $217,600 resulting in a 2.5 to 1.0 benefit-cost ratio.

DESCRIPTION OF THE WATERSHED

Physical Data

Clarks Fork-Bullocks Creek Watershed is located in north-central South Carolina in York County, with about two percent of the area extending into Cleveland County, North Carolina. The watershed lies about half-way between Charlotte, North Carolina and Spartanburg, South Carolina, and is three miles west of York, the county seat of York County. The towns of Hickory Grove, Sharon, and Smyrna lie along the watershed boundary. The watershed covers 77,500 acres and is about 24 miles long and 8 miles wide. A map of the watershed is shown on Page 43.

The watershed is located in the Southern Piedmont Land Resource Area. Topography ranges from rolling to steep. Some streams resemble those of the mountains, but others are more typical of the Piedmont. Elevations range from 1,300 feet MSL on Kings Mountain to 400 feet at the watershed outlet on Broad River. Principal streams draining the area are Bullocks Creek, Clarks Fork, and Buckhorn Creek. Drainage is generally in a southerly direction. Surface water appears to be of very high quality and sediment is the only known pollutant.

Portions of Kings Mountain State Park and Kings Mountain National Military Park lie in the northern portion of the watershed. This area is the site of the Battle of Kings Mountain, regarded by historians as the turning

KINGS MOUNTAIN STATE PARK PROVIDES A WIDE VARIETY OF RECREATION ATTRACTIONS. THE STATE PARK IS NEXT TO THE NATIONAL MILITARY PARK WHICH COMMEMORATES THE BATTLE OF KINGS MOUNTAIN.

point of the Revolutionary War. In the National Park, just outside the watershed boundary is a museum which contains a diorama and many relics of the Revolutionary War. Visitors may walk along the battle lines and entrenchments used by American and British soldiers during the battle. Within the watershed, the State Park contains a camp ground, swimming area, picnic area and other recreational attractions.

There are no large water users in the watershed. Water for the towns of Sharon, Smyrna, and Hickory Grove, Kings Mountain State Park, and rural residents is supplied by wells. Agricultural water is supplied primarily by farm ponds.

The overall hydrologic condition is average, but is greatly improved over that which existed when up and down hill cultivation was common. Hydrologic conditions should continue to improve with better management and protection of the land resources. Over half of the woodland is pine and the remainder is pine mixed with hardwoods. The woodland stands provide excellent protection to the soil mantle and contribute to an improved hydrologic condition.

The major rock types in the watershed are gneissic granodiorite, phyllite schist, tonalite, and amphibolite. The soil associations conform to the underlying rocks in the following manner: (1) Tatum-Nason-Manteo to phyllite schist and tonalite, (2) Wilkes-Lloyd-Enon to gneissic granodiorite, and (3) Enon-Iredell-Wilkes to amphibolite.

The watershed is in the North Central Climatic Division of South Carolina. The average annual rainfall is 45 inches. The annual precipitation is 24 percent in the spring, 31 percent in the summer, 20 percent in the fall and 25 percent in the winter. The mean annual temperature is 62 degrees Fahrenheit. The mean monthly temperature ranges from 80 degrees in July to 46 degrees in January.

Economic Data

The population of the watershed is about 4,000, most of which is rural. Income within the area is mainly derived from agriculture and employment in several surrounding industrial and trading centers. Principal farming enterprises are livestock, forest products, grains, soybeans, peaches, and poultry. Textile and other manufacturing firms in the vicinity of York, Rock Hill, Clover, Gaffney and Blacksburg provide employment for a large number of local residents.

The estimated 340 farms in the watershed average about 200 acres in size and $35,000 in value. Most of these are low income family farms and more than half produce annual sales of less than $2,500. Very few farming operations hire full time laborers and only a small amount of seasonal and custom labor is utilized.

The average value of the upland in the watershed is $325 per acre. Flood plain values range from $75 per acre in swamped areas to $500 where flooding is not severe.

The present land use in the watershed is as follows:

Land Use	Acres	Percent
Cropland	8,500	11
Grassland	15,500	20
Woodland	50,400	65
Other Land	3,100	4
TOTAL	77,500	100

All of the land is in private ownership, except approximately 1,880 acres owned by the U.S. Department of Interior and 5,070 acres owned by the South Carolina Department of Parks, Recreation and Tourism in the northern portion of the watershed. These areas are portions of Kings Mountain National Military Park and Kings Mountain State Park.

An excellent network of improved secondary roads and State Highways connect the watershed with markets in Charlotte, York, and Rock Hill. Interstate Highway 85 is located approximately five miles north of the watershed boundary. The area is also served by the Southern Railroad.

Ninety-six percent of the woodland is in upland species including pines, oaks, red cedar, yellow poplar, sycamore, sweetgum, hickory, and dogwood. Flood plain species include red maple, yellow poplar, ash, sycamore, cottonwood, gums, and oaks.

Sixty-four percent of the woodland is stocked with good merchantable species. The sawtimber volume averages 741 board feet per acre of pine, and 1,556 board feet per acre of hardwood. The pulpwood averages 224 cubic feet per acre for pine, and 162 cubic feet per acre for hardwood.

The South Carolina State Commission of Forestry, and the North Carolina Forest Service, in cooperation with the U.S. Forest Service, through the various Federal-State cooperative forestry programs, is providing forest management assistance, forest fire protection and suppression, distribution of planting stock, and forest pest control assistance to private landowners in the watershed. Forest management activities within the National and State Parks are confined to removal of overmature and damaged trees. Fire protection is administered by the South Carolina State Commission of Forestry and the North Carolina Forest Service units.

Land Treatment Data

The project area is served by the Soil Conservation Service Work Unit Offices in York, South Carolina and Shelby, North Carolina. These offices assist the York and Cleveland Soil and Water Conservation Districts and the Clarks Fork-Bullocks Creek Watershed Conservation District. The conservation programs offered by the Districts are based on the wise use, necessary treatment, and proper management of the soil, water, and wildlife resources within the area. A soil survey report has been published for York County.

The two Districts have assisted 200 landowners in the watershed with soil and water conservation plans. These plans cover 40,800 acres, or about 53 percent of the watershed. About 33,000 acres are adequately treated with measures valued at $1,100,000. See Table 1A.

Most of the soils in the cultivated areas are Capability Classes IIe, IIIe, and IVe. Land use trends indicate that a portion of the upland now in row crops will be changed to grassland, woodland, or urban development. Most of the flood plain soils are Capability Classes IIw, IIIw, and IVw.

Fish and Wildlife Resource Data

Most of the fishing opportunity in the watershed is furnished by farm ponds which are stocked with bass, bluegill (bream), and channel catfish. Streams support a sucker-type fishery and fishing pressure on them is light.

Wildlife habitat consists of woodland interspersed with agricultural lands. The South Carolina Wildlife Resources Department has recently undertaken a program to re-establish deer and wild turkey. That portion of the watershed lying south of S.C. Highway 97 is currently within Hunt Unit I of the Department's game management program for public hunting. As the populations of deer and turkey increase, additional areas in the watershed will be added to the program. The watershed has good populations of farm game species such as bobwhite quail, rabbit, squirrel and dove. Local residents prize the aesthetic value of non-game birds. Furbearers such as raccoon and opossum formerly contributed to the local economy, but presently there is little demand for these pelts.

The watershed has low value as natural waterfowl habitat. Some ducks use the farm ponds during migration, however, the ponds do not produce an adequate supply of duck food. There are several good sites where waterfowl habitat could be created and managed, if desired by the landowners.

WATERSHED PROBLEMS

Floodwater Damage

A major problem in the watershed is flood damage to 3,355 acres of fertile flood plain land. A three-year frequency storm floods about 2,800 acres. Some areas flood as often as five times per year. More than one-third of the floods occur during the growing season.

A portion of the flood plain once used for high producing crops and pasture has reverted to less intensive use. Flood damage to existing crops and pasture has caused increased production and maintenance costs, hampered good management practices, and prevented intensive use of much of the flood plain. These damages amount to $32,300 annually. Damages to other agricultural property, including fences and fixed farm improvements, farm roads and bridges, and livestock losses, are estimated to total $13,700 annually.

Nonagricultural damages such as scoured road surfaces, erosion of bridge abutments, bridge and culvert wash-outs, and damages to other permanent improvements total $4,400 per year.

These damages combine to limit the opportunities for development. Income which could provide a higher standard of living is, instead, used to replace machinery and equipment that are damaged or destroyed by floodwater. Destroyed crops represent opportunities which will have to be foregone due to the loss of income. Funds which are presently being used to repair roads and bridges damaged by floods could be used to provide children with better

FLOODING ALONG BULLOCKS CREEK NEAR S.C. HIGHWAY 97 FOLLOWING THREE INCHES OF RAINFALL ON MARCH 14 and 15, 1964.

FLOODING ALONG BULLOCKS CREEK NEAR S.C. HIGHWAY 97 FOLLOWING ABOUT FIVE INCHES OF RAINFALL ON APRIL 6, 7, and 8, 1964.

schools and educational opportunities, as well as create a more desirable environment for the residents of the area.

Erosion and Sediment Damages

Erosion, although severe in the past, is not a serious problem in this watershed at present. Nevertheless there are some critical sediment source areas needing treatment. Sediment damage, from previous years of erosion, is severe in some areas. Damages due to flood plain scour are minor and have been included with floodwater damage.

The upland cover of the drainage area of Clarks Fork above S.C. Highway 55 is good and erosion is minor. From Highway 55 to the confluence with Bullocks Creek, sediment deposits gradually increase until the stream becomes a series of pools and the flood plain wet and unproductive at the confluence. Coarse grained sand splays above and below bridge openings are common in this reach.

FLOOD PLAIN SCOUR ALONG CLARKS FORK NEAR S.C. HIGHWAY 55 CAUSED BY HEAVY RAINS IN JULY 1965.

SEDIMENT DEPOSITED ALONG CLARKS FORK AFTER HEAVY RAINS IN JULY 1965.

Bullocks Creek, near the confluence with Clarks Fork and also about two miles above the confluence with Buckhorn Creek, has been severely damaged by sediment deposition caused by past years of upland erosion. Above the Buckhorn Creek confluence, a channel has been excavated in an attempt to reduce flooding. Sediment damages are minor in the area of the excavated channel, but flooding has not been eliminated and wet areas are common along the edge of the flood plain.

Sediment damages on Bullocks Creek below its confluence with Clarks Fork are severe at the following locations: (1) swamping in the uppermost

mile of the reach, (2) sediment deposition in the channel near Mitchell and Plexico Branches, and (3) flood plain splays of coarse grained sediment on the downstream side of bridge openings. Over the remainder of this reach, sediment damages are moderate.

Sediment and erosion damages on Loves Creek and Buckhorn Creek are minor and consist primarily of deposition on the flood plain near their outlets.

The estimated average annual sediment delivered at the outlet of the watershed is 21,600 tons, which represents an average concentration of 130 p.p.m. Approximately 80 percent of this sediment is in a suspended state.

The average annual sediment damages for the watershed are $22,000.

Problems Relating to Water Management

Increased usage of Kings Mountain State Park has created a need for expansion of facilities. The Park is operated by the South Carolina Department of Parks, Recreation and Tourism and is the primary recreation attraction in the area. A recent study by the Department indicates that additional recreational facilities are needed at Kings Mountain to satisfy present needs and to help meet future demands of recreation for the entire State.

The streams of the watershed have been classified "A", which will meet requirements for the intended usage. Other than sediment, there are no known pollutants being discharged into the streams.

PROJECTS OF OTHER AGENCIES

An existing 65 acre lake in Kings Mountain State Park is presently utilized for recreation in the group camping area of the Park. The recreation pool of Structure 12 will impound water up to the existing lake level, forming one continuous lake of 650 acres. The existing dam will be removed. The recreational development planned will supplement the existing facilities.

The Corps of Engineers has made a study of the Greater Lockhart Dam and Reservoir located on the Broad River. This Corps' project would affect the lower portion of Clarks Fork-Bullocks Creek Watershed, however, their evaluations indicate that it is not feasible and construction is not anticipated within the near future. There are no plans for water resource development in the watershed which would be in conflict with the Clarks Fork-Bullocks Creek Watershed project.

There are no known historical or acheological features of national

significance within the proposed construction or impoundment areas. However, prior to construction, the Secretary of the U.S. Department of Interior will be notified as required by Public Law 86-523.

PROJECT FORMULATION

Project objectives as agreed upon by the sponsors and the Service are: (1) to apply needed land treatment measures and desirable land use adjustments for watershed protection; (2) to treat critical sediment source areas as needed; (3) to protect most of the flood plain from a three-year frequency flood; (4) to increase recreational facilities at Kings Mountain State Park; (5) to protect and improve the fish and wildlife resources; (6) to promote and stimulate the economic growth of the community; and (7) to improve the overall environment of the area.

Land treatment goals are adequate treatment of at least 75 percent of the cropland, 70 percent of the grassland, and 65 percent of the woodland by the end of the installation period. The allowable soil loss on cropland is three tons per acre per year.

The forest fire loss from 1959 through 1968 met the watershed protection goal of 0.20 percent or less. The proposed works of improvement will not increase the fire hazard or risk. No intensification of the going forest fire control program is needed.

To accomplish flood control objectives, recognition has been given to agricultural needs and trends. Generally, a higher degree of flood protection is planned for those areas having intensive use. Several alternate systems of structural measures were analyzed. Individual structures on Clarks Fork and on Bullocks Creek just above their confluence were considered as an alternate. However, it was determined that a greater degree of flood protection could be obtained at less cost by utilizing Structure 15. Channel improvement for flood protection was considered to supplement the various alternates of structures studied. As project formulation progressed, it became apparent that the desired level of flood protection could be obtained without stream channel improvement.

The addition of recreation as a project objective has been coordinated with the South Carolina State Outdoor Recreation Plan. This plan provides for the enlargement of Kings Mountain as a Destination Park, meaning that it will be one of seven parks serving the needs of the entire State as well as out-of-state visitors. To meet these needs, the goal of the S. C. Department of Parks, Recreation and Tourism was to provide facilities to meet a capacity for 300 persons in the primitive camp area, 400 campers, and 300 persons picnicking.

An outstanding opportunity for developing high quality waterfowl habitat will be available at Structures 15 and 19. In each of these pools,

a two or three foot drawdown would expose a considerable amount of land suitable for waterfowl food plantings. Raising the water over the plantings in the fall would make the food available for ducks. This could be accomplished by a drawdown gate in the principal spillway. Individual landowners involved in the structures have expressed interest in paying for the drawdown gate. Their final decision can be made any time prior to design of the structures.

Careful attention has been given to the effects of this project on both the physical and economic environment. The well-being of man and other creatures has been considered. The project has been coordinated with the U.S. Bureau of Sport Fisheries and Wildlife, the S.C. Wildlife Resources Department, and the N.C. Wildlife Resources Commission.

Clarks Fork-Bullocks Creek Watershed project is considered as a primary need to meet the objectives of the U.S. Department of Agriculture's Santee River Basin Study in reducing flood damages, providing recreational facilities, and overall improvement of the environment.

Two of the structures, 15 and 19, have excellent potential for the storage of additional water for beneficial use. Efforts have been made to inform all interests of this potential, however, at this time, no organization is willing to sponsor the development of this storage. The design of these structures will allow for future enlargement.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

About 2,500 acres of cropland will be treated with a combination of measures. These include conservation cropping systems, grassed waterways and outlets, open and tile drains, terraces, field border plantings, access roads, and other practices. For the two percent of the watershed in Cleveland County, North Carolina, no intensification is needed for the land treatment program.

Land treatment measures on about 6,500 acres of grassland will consist of pasture and hayland planting and management, ponds, drainage mains and laterals, and proper grazing use. About 800 acres of land will be developed for wildlife and recreation. Lespedeza bicolor, other food and cover crops, access roads, recreation area stabilization and improvement, land grading and shaping, trails, and walkways will be installed as needed.

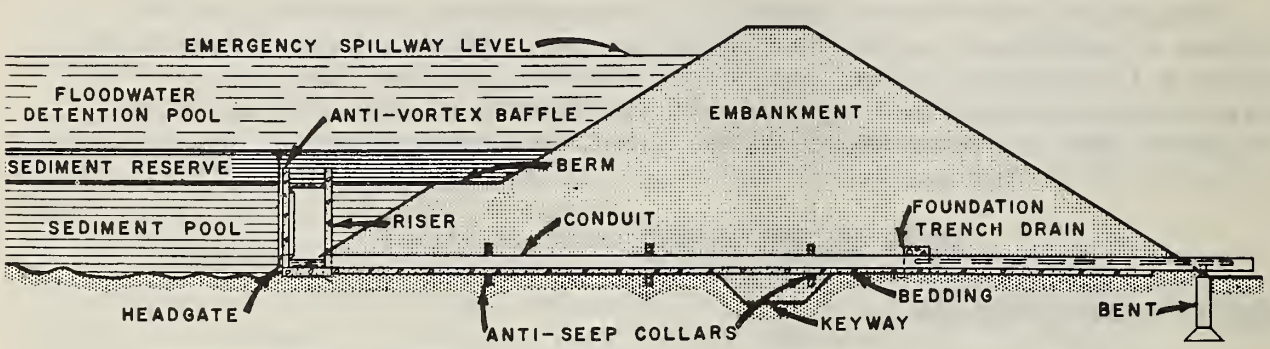
Appropriate vegetative cover will be used to treat 360 acres of critically eroding areas within the watershed. About 190 acres of open, critically eroding lands will be stabilized by planting trees. Approximately 170 acres will be treated with grasses and legumes.

A forest management program aimed at fulfilling watershed needs and

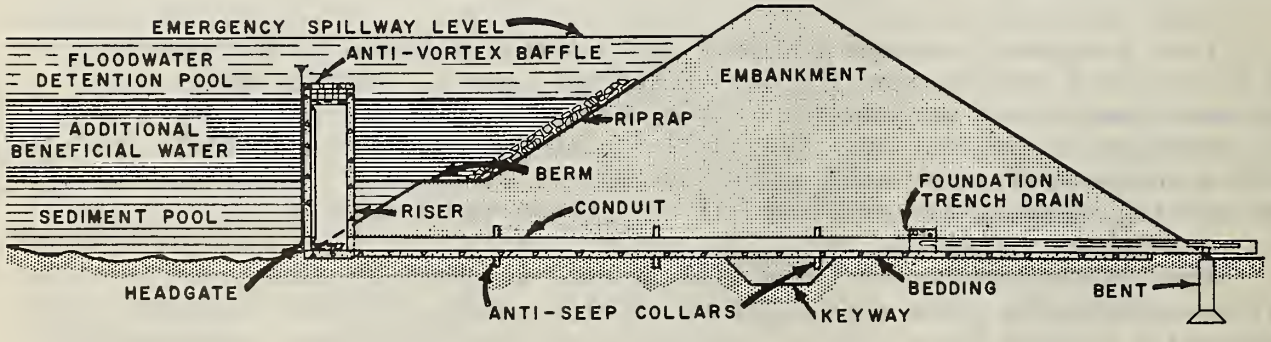
objectives will be followed. The forest lands will be managed to fulfill timber, wildlife, and recreation needs to the extent that it is compatible with sound watershed management. Reforestation of appropriate open land and understocked stands is planned for 1,050 acres. Stand improvement measures aimed at improving hydrologic conditions will be carried out on about 6,750 acres. These measures include removal of inferior species and cull trees, thinnings and harvest cuttings, improvement work by release, and stand improvement by conversion. The South Carolina State Commission of Forestry and the North Carolina Forest Service will continue the going Cooperative Forest Fire Control Program in the watershed area.

Structural Measures

Structural measures consist of six single purpose structures for flood control and one multiple purpose structure for flood control and recreation. The planned location of structural measures is shown on Page 43. Design data are shown in Table 3.



SECTION OF FLOODWATER RETARDING STRUCTURE



SECTION OF MULTIPLE PURPOSE STRUCTURE

The total drainage area above all structures is 59,860 acres. Structure 12 will provide a 650 acre recreation pool with 12,936 acre feet of recreation water in addition to 4,000 acre feet of temporary flood storage. The remaining structures will provide a total of 15,914 acre feet of temporary storage for flood prevention.

All seven structures will consist of earthfill embankments and vegetated emergency spillways. The principal spillways for Structures 12 and 18 will be on non-yielding foundations. The principal spillway for Structure 15 will consist of a reinforced concrete inlet, box culvert, and S.A.F. Outlet. The principal spillway for each of the other six structures will have a reinforced concrete inlet and pipe and will outlet into an excavated plunge basin. The emergency spillways for the structures have a two percent or less chance of operation in any year.

All structures are designed for an effective life of 100 years. The crest elevation of the principal spillways for Structures 2, 15, 18, and 19 will be the 100-year sediment pool. The principal spillway crest elevation of Structures 14 and 56 will be at the 50 year sediment pool. The crest elevation of the principal spillway for Structure 12 will be the maximum elevation of the recreation pool. The upstream face of Structures 2, 12, 15, and 19 will be riprapped in the area subject to wave action.

Recreational Facilities

Recreational facilities included for Structure 12 are shown on the Public Recreation Development Map on Page 42 and listed in Table 2B. The recreation development area consists of 2,020 acres and includes a 650 acre lake. Of the entire 2,020 acre area, 1,470 acres are already owned by the S.C. Department of Parks, Recreation and Tourism, leaving 550 acres to be purchased. The development area will allow full public use of the reservoir by preventing private property encroachment.

Paved roads and parking areas will consist of one and one-half inches of asphaltic surface over a six inch crushed stone base. The width of the paved surface will be 22 feet. All roads and parking areas will generally follow the contour. Appropriate vegetation will be established on all cuts and fills. Drainage will be provided by collection ditches and culverts where necessary.

Three South Carolina State Park standard picnic units are included. Each of these units consists of 25 wood picnic tables, 15 cast iron grills, 15 underground waste receptacle units, and a comfort station.

Each of four standard family camp units consists of 25 site developments, 25 wood picnic tables, 25 cast iron grills, 25 underground waste receptacles, and a comfort station with showers. The minimum distance between each camp site will be 75 feet. Water will be distributed to each camp site and electricity will be provided to about half of the sites. A sewage dump

station will serve the family camp area.

The primitive area will include three timber picnic shelters (approximately 20' x 40' with a concrete floor) and 75 Adirondack Type Primitive Shelters with open fronts and dirt floors. Approximately 50 of the primitive shelters will be scattered in a more or less isolated area to provide an opportunity for primitive type camping experiences for individuals or small groups. The remainder of the primitive area will be utilized by larger groups of up to 75 persons. Fifty pit toilets with sealed underground vaults will be provided.

The overlook area will afford a scenic view of the area from a vantage point 60 feet above the level of the recreation pool. The foot trail leading to this area will be paved for a portion of the way to allow easier access for the physically handicapped.

The boat launching ramp, approximately 12 feet wide, will be constructed of reinforced concrete logs. Boat docks will be constructed of two inch treated lumber.

Playground equipment consisting of sliding boards, swing sets, basketball goals, and various climbing apparatus is included. Water will be supplied by wells, distribution lines, and fixtures. In the primitive area, the water supply will be located at selected central locations. A package treatment plant is planned for sewage disposal. All sanitary facilities will be approved by appropriate federal, state, and local health authorities prior to installation. Signs for identification and directions are included. Underground electrical distribution lines throughout the area will provide light and power. The area will be landscaped as needed.

EXPLANATION OF INSTALLATION COSTS

Land Treatment

Land treatment measures to be applied during the project installation period are estimated to cost $730,500. Of this total, $164,000 will be PL-566 funds and $566,500 will be other funds.

To meet the goals of adequate land treatment, PL-566 funds will provide $73,000 for accelerated technical assistance by the Soil Conservation Service and $52,000 by the U.S. Forest Service. In addition, PL-566 funds will provide $24,000 for cost sharing on critical area plantings by the Soil Conservation Service and $15,000 for tree planting on critical areas by the U.S. Forest Service.

The remaining technical assistance cost will be provided by other funds under the going programs of the Soil Conservation Service ($27,000), the U.S. Forest Service, by and through the South Carolina State Commission of

Forestry and the North Carolina Forest Service ($9,000), and the going Cooperative Forest Management Program ($2,000). The South Carolina State Commission of Forestry and the North Carolina Forest Service will continue the going Cooperative Forest Fire Control Program, at an estimated value of $10,000.

The remainder of other funds will be borne by individual landowners and operators, utilizing the cost sharing assistance available through the Rural Environmental Assistance Program. These costs include material, labor, and machinery necessary for the installation of land treatment measures.

Structural Measures

Total structural installation cost is $3,380,900 and consists of construction, engineering services, project administration, and land rights.

The construction cost of each structural measure is the estimated cost of all material and labor necessary for construction. These costs, estimated to be $2,185,700, were determined for each structure by estimating the quantities required for construction and applying unit costs based on previously constructed projects. Included in the construction cost is a 12 to 15 percent contingency allowance to cover unforeseen items that may be encountered during construction.

Engineering services, estimated to be $134,800, consist of the cost of design surveys, geological investigation, design and preparation of plans and specifications for the structural measures.

Land rights costs, estimated to be $747,500, include all land values and expenditures made in acquiring land, easements, and rights-of-way and all costs associated with altering roads, power lines, and other fixed improvements affected by the structural measures. Structures 15 and 19 will require changes to fixed improvements. A Duke Power Company 230 Kv transmission line, an overhead telephone line, and two paved highway bridges, will have to be altered above Structure 15. A dirt road above Structure 19 will have to be altered. Existing dirt roads above Structures 12, 14, and 18 will be abandoned because changes would be impractical and alternate traffic routes are available.

Project administration costs, estimated to be $312,900, consist of costs associated with the installation of structural measures including contract administration, review of engineering plans prepared by others, Government Representatives, construction surveys, and inspection during construction.

For the structural measures, except for recreational facilities, PL-566 funds will pay all costs of construction and engineering services allocated to flood prevention, half of the construction costs allocated to recreation, and all of the engineering services allocated to recreation. For the recreational facilities at Structure 12, PL-566 funds will pay half the

costs of the construction and engineering services. PL-566 funds will pay half of the purchase price of 550 acres of land for Structure 12 and the recreation development area. The additional 1,470 acres needed for Structure 12 are presently owned by the South Carolina Department of Parks, Recreation and Tourism. Other funds will pay all other costs including the costs of land surveys and legal fees. Project administration costs are not allocated as they are not considered applicable to individual purposes served by the project. The Service and the Sponsoring Local Organizations will bear their respective project administration costs. The Service will bear the costs of administering construction contracts for all structural measures, except the recreational facilities which will be borne by the South Carolina Department of Parks, Recreation and Tourism.

Estimated installation cost of Structures 2, 14, 15, 18, 19, and 56 amounts to $1,309,900, all of which was allocated to flood prevention.

Construction and engineering services costs for Structure 12 were allocated by the Use of Facilities Method. Using this method, 74.8 percent of these costs were allocated to recreation and the remainder to flood prevention. All the costs of land purchase were allocated to recreation.

The estimated total installation cost of this structure amounts to $932,500, of which $760,000 was allocated to recreation (Table 2A). Of the amount allocated to recreation, PL-566 funds will pay $315,400 and other funds $444,600. Of the $172,500 allocated to flood prevention, the other cost amounts to $600 and the PL-566 cost is $171,900. The total other cost for this structure is estimated to be $445,200.

The installation of recreational facilities planned in conjunction with Structure 12 are estimated to cost $825,600, of which $340,200 will be borne by PL-566 funds and $485,400 by other funds. All of these costs were assigned to recreation.

Following existing procedures of cost sharing, the total PL-566 cost for the structural measures is $1,797,400, and other costs amount to $1,270,600 (Table 2A). Adding project administration costs, the total is $2,060,300 for PL-566 and $1,320,600 for other (Table 2).

Schedule of Obligations

Estimated expenditures by years are as follows:

Project Year	PL-566 Funds		Other Funds	
	Structural Measures	Land Treatment	Structural Measures	Land Treatment
First	177,600	41,000	400,900	141,300
Second	499,100	32,800	310,500	113,400
Third	181,800	32,800	75,000	113,400
Fourth	223,200	32,800	86,100	113,400
Fifth	237,500	24,600	135,800	85,000
Sixth	453,100	-	260,300	-
Seventh	180,600	-	31,000	-
Eighth	107,400	-	21,000	-
TOTAL	2,060,300	164,000	1,320,600	566,500

EFFECTS OF WORKS OF IMPROVEMENT

Land treatment measures will increase soil build-up by stabilizing the soil and reduce erosion by providing better ground cover to retard runoff. Forest litter produced under proper forest management and protection is the source of a good humus layer. Measures to be applied on cropland and grassland will reduce soil loss to within the allowable limits. Sound land use and treatment will contribute to the overall economy of the area. Increased farm income and efficiency, beautification of the surrounding countryside and improved land use and soil conditions will all combine to create an outstanding example of conservation.

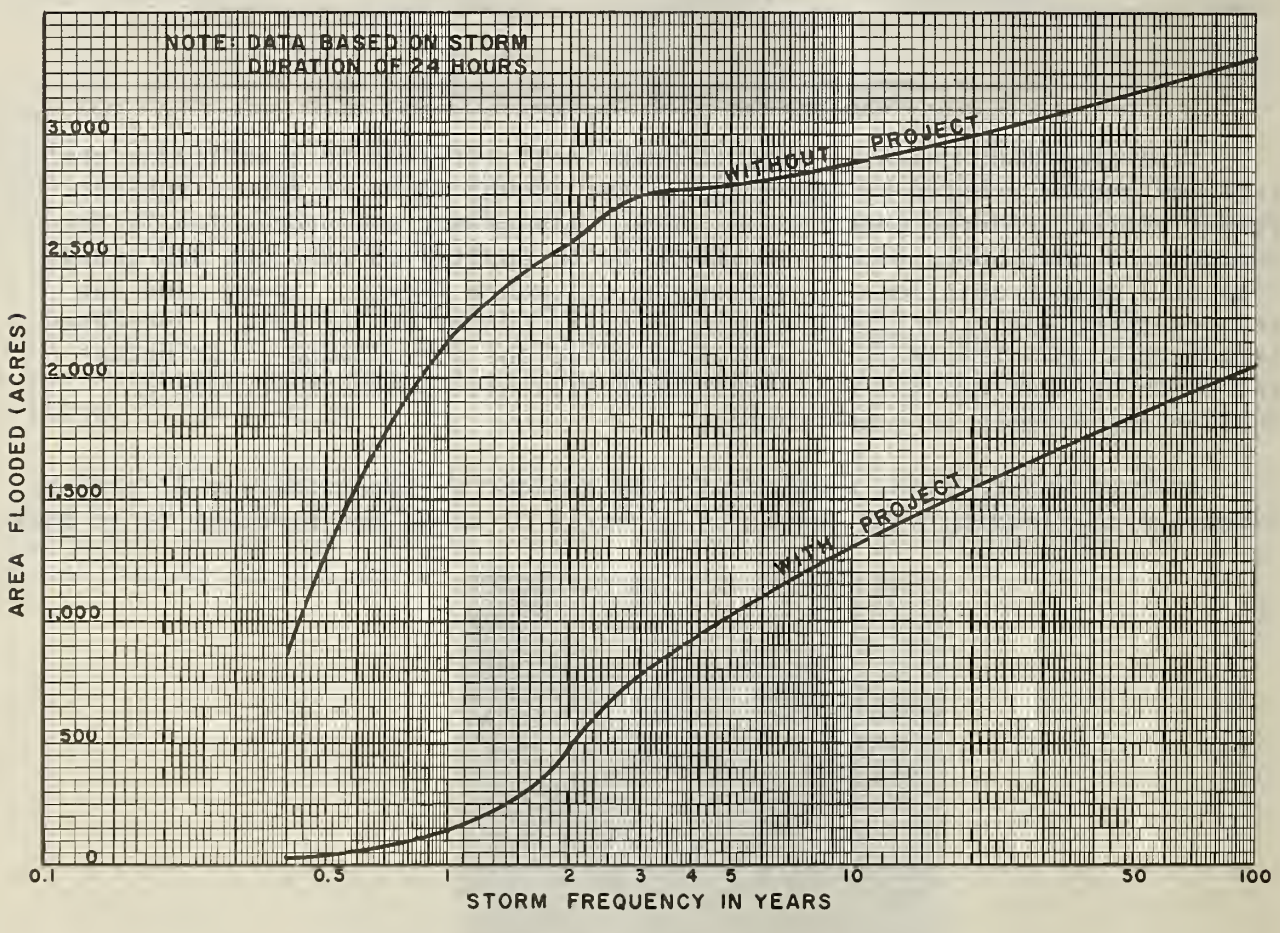
Average annual flood damages will be reduced by approximately 87 percent. Reduction of flooding will permit 1,300 acres of crops and pastures to be used

REDUCED FLOODING WILL ALLOW MORE INTENSIVE USE OF PASTURES.

more intensively. In addition, the protection afforded will allow farmers to establish and maintain about 300 acres of cropland and 500 acres of high producing pastures. Most of the remaining acreage in the benefited area is expected to be used for timber production.

As a result of changes in flood plain land use, and in an effort to use each acre of land within its capability, 2,000 acres of cultivated upland can be converted to grasses, legumes, and tress. Other beneficial land use adjustments include treatment of 360 acres of critically eroding areas. Sediment delivered at the watershed outlet will be reduced from 21,600 to 5,020 tons annually.

About 3,355 acres of flood plain below proposed structures will benefit directly from the flood reduction, increasing the income of about 100 farm families. The average annual area flooded, including repetitive flooding, will be reduced from about 6,900 to 1,150 acres by the proposed structures and land treatment. The area flooded below proposed structures is shown by storm frequency in the graph below.



EFFECT OF PROJECT ON FLOOD REDUCTION

Approximately 230,000 visitor days of recreation are expected annually from Structure 12 and the adjacent facilities. Recreational use will include fishing, boating, picnicking, hiking, and camping. The design capacity of the recreational facilities is 1,750 persons.

In addition, it is anticipated that the pool areas of the remaining structures will be made available to the general public or organized groups for incidental recreational activities. It is estimated that average annual use at these sites will total 29,550 visitor days. Prior to making the pools available, sanitary facilities will be installed in accordance with State health laws. Where sanitary facilities are not provided, the sponsors will discourage use of the pools.

The impoundment of 1,044 acres of water in the seven structures will greatly increase the fishery resource. In addition, reduced flooding will decrease the sediment pollution and allow presently clogged channels to slowly cleanse themselves. Water quality will be improved by increasing the low flow. With this improved environment, small organisms upon which fish prey will be better able to survive and thereby improve the fishery resource.

Wildlife resources in the watershed will be substantially enhanced. The development and management of 500 acres for wildlife food and cover on uplands, land treatment measures, and critical area stabilization will improve the upland habitat. Reduced sedimentation on the bottom lands will result in better soil development and improved forage and cover. Wildlife habitat will be further enhanced by the inclusion of wildlife border strips and multi-use timber management.

Construction of the proposed project will create additional employment for local residents. Contractors will hire much of their labor locally. Operation and maintenance of structural measures during the life of the project will also help reduce unemployment and underemployment.

Secondary benefits will accrue from increased business in the area and a generally improved economic situation. Income will be stimulated by an increase in production, transporting, processing, and marketing of goods and services. Improved land use, increased farm income, and additional recreational facilities will enhance the economic development of the community.

The reduction in flood damages will release funds which were previously committed to the repair or replacement of farm equipment. Money that was formerly spent on the repair of roads and bridges can now be used to improve the educational opportunities of the area. The overall effects of the project will greatly aid in community development and create a more desirable environment for the residents of the area.

PROJECT BENEFITS

The average annual benefits from structures which were evaluated are estimated to be $535,000 (Table 6). By categories, these benefits are: flood damage reduction, $64,700; more intensive land use, $43,000; recreation, $345,000; incidental, $26,300; and secondary, $56,000. The monetary values of fish and wildlife enhancement, reduction in health and safety hazards, and improvement of the overall environment were not evaluated.

Flood damage reduction benefits from structures and land treatment include: floodwater, $44,700; sediment, $18,700; and indirect, $6,000. Land treatment measures account for $4,700 of the damage reduction benefits listed in Table 5.

Recreation benefits that will result from the use of multiple purpose Structure 12 and the recreational facilities are estimated to be $345,000 annually. These benefits are based on a value of $1.50 per visitor day and 230,000 visitor days each year.

Incidental recreation benefits will amount to about $26,300 annually. These benefits are based on a value of $1.00 per visitor day. No benefits have been claimed for increased land values.

The value of local secondary benefits that will accrue in the watershed and surrounding area due to project installation amounts to $56,000. The value of secondary benefits from a national viewpoint was not considered in the economic evaluation or justification of this project.

Research and experience have shown that benefits derived from land treatment measures exceed their cost of installation and therefore were not evaluated. Benefits that will result from the land treatment program include reduced erosion, lower sediment yields, improved hydrologic conditions, and greater soil productivity.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the structural measures, including operation and maintenance, is estimated to be $217,600. These measures are expected to produce average annual benefits of $535,000. The ratio of average annual benefits to average annual costs is 2.5 to 1. The benefit-cost ratio without local secondary benefits is 2.3 to 1. A comparison of benefits and costs is shown in Table 6.

PROJECT INSTALLATION

Land Treatment

The application of land treatment will be accelerated for a five year period. Measures will be established by landowners cooperating with the York Soil and Water Conservation District. The District, with technical help from the Soil Conservation Service, will assist with the planning and application of these measures.

Landowners having forest land will be encouraged to apply and maintain proper forestry measures. The U.S. Forest Service, through the South Carolina State Commission of Forestry, will provide technical assistance for the application of forest land treatment measures. A forester trained in watershed management will assist the landowners in the installation of the planned forestry measures.

The South Carolina State Commission ofForestry, in cooperation with the U.S. Forest Service will assist the District cooperators with tree planting on 190 acres of critical areas. This will be accomplished in accordance with conservation plans developed with assistance from the York Soil and Water Conservation District and the Soil Conservation Service. Site preparation and tree planting will be paid by PL-566 funds. Landowners will provide seedlings and mulch materials and construct or relocate fences where necessary.

The Soil Conservation Service will provide technical assistance for the establishment of grasses and legumes on 170 acres of critical areas. In addition, this increment of work will be carried out on a division of work basis as set forth in the Work Plan Agreement.

The value of the work which the Service is to perform does not exceed cost-sharing rates for such practices applicable under other going programs.

All critical area plantings will be done through project agreements and District Cooperative Agreements with the York Soil and Water Conservation District.

Structural Measures

The Clarks Fork-Bullocks Creek Watershed Conservation District will be responsible for obtaining land rights required for the installation of Structures 2, 14, 15, 18, 19, and 56. The South Carolina Department of Parks, Recreation and Tourism will be responsible for obtaining land rights required for the installation of Structure 12 and the recreational facilities. The Watershed District will aid in obtaining these land rights. The sponsors have the necessary legal authority to acquire these land rights. The sponsors will obtain needed land rights at least one year prior to construction of each construction unit.

The Service will provide the engineering services for all the structures. The South Carolina Department of Parks, Recreation and Tourism will negotiate an A&E contract with a private engineering firm for the engineering services for the recreational facilities. All construction contracts will be awarded on a competitive bid basis.

The sponsors have requested that the Service administer the construction contracts for all structural measures, except the recreational facilities. The South Carolina Department of Parks, Recreation and Tourism will administer the construction contracts for the recreational facilities and deal with the Service during the construction of Structure 12 and the recreational facilities. The Clarks Fork-Bullocks Creek Watershed Conservation District will be the sponsor responsible for dealing with the Service during the construction of all flood detention structures.

The structural measures are grouped in construction units as shown in Table 7. Each of these units may be constructed as land rights are obtained and funds are available. Structures 2, 12, 14, and 19 must be installed prior to Structure 15.

Planned installation schedule for the structural measures is as follows:

Project Year	Structural Measure 1/
Second	Structure 12
Third	Structure 14
Fourth	Structure 2
Fifth	Structure 19
Sixth	Structure 15
Seventh	Structure 56
Eighth	Structure 18

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement described in this Work Plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (PL-566), as amended. Financial and other assistance to be furnished by the Service in carrying out the plan is contingent upon the availability of funds for this purpose.

The following conditions must be met prior to the Service providing

1/ Recreation facilities for Structure 12 will be installed over a five year period beginning with the second project year.

financial assistance for the construction of any planned structural measure: (1) the York Soil and Water Conservation District will obtain agreements with landowners to carry out soil and water conservation plans on at least 50 percent of the area above each structure, (2) adequate land treatment measures must be applied on at least 75 percent of those sediment source areas, which, if uncontrolled, would materially increase the cost of construction, operation, or maintenance of the structural measures, (3) all land rights must be obtained for all structural measures within a construction unit, (4) specific operation and maintenance agreements must be executed, and (5) the Sponsoring Local Organizations must be prepared to discharge their responsibilities.

The cost of applying land treatment measures on private land will be borne by the landowners and operators. The Rural Environmental Assistance Program and other going programs will provide cost sharing and technical assistance for land treatment measures which qualify.

The cost of establishing 360 acres of critical area plantings, except the PL-566 share, will be borne by the individual landowners. The landowners' share will be done in accordance with the division of work as set forth in the Watershed Work Plan Agreement.

The other than PL-566 share of the costs involved in the application of forest land treatment measures will be provided by the landowners and operators. It is expected that Agricultural Stabilization and Conservation Service cost sharing will be available to help qualified landowners in the installation of these measures.

The sponsors expect necessary land rights to be donated for all structures, except Structure 12. The South Carolina Department of Parks, Recreation and Tourism will obtain fee simple title to about 550 acres of land for Structure 12 and the area for the recreational facilities. The remaining 1,470 acres within the recreation development area are already owned by the South Carolina Department of Parks, Recreation and Tourism. The sponsors have the financial ability and legal authority to acquire all needed land rights that are not donated.

The South Carolina Department of Parks, Recreation and Tourism expects to utilize appropriated funds within the agency's annual operating budget to meet its financial obligations.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by the owners and operators of the land on which they are installed in cooperation with the York Soil and Water Conservation District. The South Carolina State Commission of Forestry and the North Carolina Forest Service, in cooperation with the U.S. Forest Service, will furnish the technical assistance necessary for the

forest land treatment measures under the going Cooperative Forest Management Program. The South Carolina State Commission of Forestry and the North Carolina Forest Service will also continue to furnish fire protection under the going Cooperative Forest Fire Control Program.

Specific maintenance agreements between the Service and the sponsors will be executed prior to issuing bid invitations for construction of each structural measure. Maintenance will include mowing, fertilizing, and controlling the vegetation, as well as the repair of damage to the emergency spillways and embankments. The recreation area will require repair and replacement of facilities, periodic stabilization of the dirt roads, and other normal upkeep. During periods of low stream flow, sufficient water will be released from sediment pools of all structures to avoid degradation of water quality. The amount available for release is limited to the capacities in the sediment pools which are subject to gradual depletion as sediment displaces the capacity for water.

The South Carolina Department of Parks, Recreation and Tourism will operate and maintain Structure 12 and the recreational facilities at an estimated annual cost of $40,900, of which about $4,100 is for periodic replacement of recreation facilities. Funds for this purpose will be obtained from the Department's annual operating budgets and user fees. The user fees will be based upon existing rates in the State Park system. The recreation development area will become part of Kings Mountain State Park and will be managed accordingly.

The Clarks Fork-Bullocks Creek Watershed Conservation District will operate and maintain all other structures. Funds for this purpose, estimated to be $2,300 annually, will be obtained from a tax levy on real property in the watershed.

For three years following installation of each structural measure, the Service and the sponsors will make joint inspections annually, after unusually severe floods, and after the occurrence of any other unusual conditions that might adversely affect the structural measures. Inspections after the third year will be made annually by the sponsors. One copy of their report will be sent to the Service representative and one copy filed by the sponsors and made available for authorized inspection. Inspections for the recreational facilities will be conducted similarly, except that the Service participation will be terminated when decided upon by the State Conservationist.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Clarks Fork-Bullocks Creek Watershed, South Carolina

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/ PL-566 Funds	Other	Total
LAND TREATMENT					
Soil Conservation Service					
Cropland	Ac.	2,500	-	71,000	71,000
Grassland	Ac.	6,500	-	312,000	312,000
Rec. & Wildlife Measures	Ac.	800	-	57,500	57,500
Critical Area Stabilization	Ac.	170	24,000	24,000	48,000
Technical Assistance			73,000	27,000	100,000
SCS Subtotal			97,000	491,500	588,500
Forest Service					
Critical Area Stabilization	Ac.	190	15,000	6,000	21,000
Forest Land Treatment	Ac.	7,800	-	48,000	48,000
Cooperative Forest Fire Control	Ac.	50,400	-	10,000	10,000
Technical Assistance			52,000	11,000 2/	63,000
FS Subtotal			67,000	75,000	142,000
TOTAL LAND TREATMENT			164,000	566,500	730,500
STRUCTURAL MEASURES					
Construction					
Soil Conservation Service					
Multiple Purpose Strs.	No.	1	408,200	243,800	652,000
Recreational Facilities			320,000	320,000	640,000
Floodwater Retarding Strs.	No.	6	893,700	-	893,700
Subtotal - Construction			1,621,900	563,800	2,185,700
Engineering Services					
Soil Conservation Service			120,500	14,300	134,800
Subtotal - Engineering			120,500	14,300	134,800
Project Administration					
Soil Conservation Service					
Construction Inspection			87,600	18,600	106,200
Other			175,300	31,400	206,700
Subtotal - Administration			262,900	50,000	312,900
Other Costs					
Land Rights			55,000	692,500	747,500
Subtotal - Other			55,000	692,500	747,500
TOTAL STRUCTURAL MEASURES			2,060,300	1,320,600	3,380,900
TOTAL PROJECT			2,224,300	1,887,100	4,111,400
SUMMARY					
Subtotal SCS			2,157,300	1,812,100	3,969,400
Subtotal FS			67,000	75,000	142,000
TOTAL PROJECT			2,224,300	1,887,100	4,111,400

1/ Price base - 1970.
2/ Includes $2,000 from the going Cooperative Forest Management Program.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Clarks Fork-Bullocks Creek Watershed, South Carolina

Measures	Unit	Applied to Date	Total Cost (Dollars) 1/
LAND TREATMENT			
Conservation Cropping Systems	Ac.	3,600	3,800
Grassed Waterway or Outlet	Ac.	30	1,600
Terrace, Gradient	Ft.	2,480,000	74,400
Terrace, Parallel	Ft.	10,000	500
Drainage Field Ditch	Ft.	39,600	19,800
Drainage Main or Lateral	Ft.	81,200	40,600
Field Border	Ft.	15,600	500
Diversion	Ft.	1,800	900
Pond	No.	75	75,000
Pasture & Hayland Management	Ac.	3,200	67,200
Pasture & Hayland Planting	Ac.	11,000	462,000
Proper Grazing Use	Ac.	2,900	3,100
Wildlife Habitat Management	Ac.	70	350
Access Road	Ft.	10,600	7,900
Recreation Area Stabilization	Ac.	40	80,000
Recreation Area Improvement	Ac.	50	3,750
Recreation Land Grading & Shaping	Ac.	25	1,900
Recreation Trail & Walkway	Ft.	7,900	800
Tree Planting	Ac.	8,700	174,000
Forest Land Release	Ac.	100	1,500
Cooperative Forest Fire Control	Ac.	50,400	75,500
Other Practices	Ac.	200	4,900
Land Adequately Treated	Ac.	33,200	-
TOTAL	XXX	XXX	1,100,000

1/ Price base - 1970.

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Clarks Fork-Bullocks Creek Watershed, South Carolina

(Dollars) 1/

Item	Installation Cost - PL-566 Funds				Installation Cost - Other Funds				Total Installation Cost
	Construction	Engineering	Land Rights	Total P.L. 566	Construction	Engineering	Land Rights	Total Other	
Multiple Purpose Structure 12	408,200	30,000	49,100	487,300	243,800	-	201,400 2/	445,200	932,500
Recreational Facilities	320,000	14,300	5,900	340,200	320,000	14,300	151,100 3/	485,400	825,600
Subtotal	728,200	44,300	55,000	827,500	563,800	14,300	352,500	930,600	1,758,100
Floodwater Retarding Structures - 2	114,800	12,300	-	127,100	-	-	18,800 4/	18,800	145,900
14	103,000	12,000	-	115,000	-	-	7,700 5/	7,700	122,700
15	338,800	18,200	-	357,000	-	-	193,000 6/	193,000	550,000
18	69,400	8,700	-	78,100	-	-	21,000 7/	21,000	99,100
19	128,800	12,600	-	141,400	-	-	68,500 8/	68,500	209,900
56	138,900	12,400	-	151,300	-	-	31,000 9/	31,000	182,300
Subtotal	1,621,900	120,500	55,000	1,797,400	563,800	14,300	692,500	1,270,600	3,068,000
Project Administration				262,900				50,000	312,900
GRAND TOTAL				2,060,300				1,320,600	3,380,900

1/ Price base - 1970.
2/ Includes $2,300 for survey and legal fees.
3/ Includes $1,200 for survey and legal fees.
4/ Includes $500 for legal fees.
5/ Includes $500 for legal fees.
6/ Includes $1,500 for legal fees and $61,000 for changes to fixed improvements.
7/ Includes $450 for legal fees.
8/ Includes $600 for legal fees, and $30,000 for changes to fixed improvements.
9/ Includes $1,000 for legal fees.

August 1970

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Clarks Fork-Bullocks Creek Watershed, South Carolina

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING					
	PURPOSE			P.L. 566			OTHER		
	Flood Prevention	Recreation	Total	Flood Prevention	Recreation	Total	Flood Prevention	Recreation	Total
Multiple Purpose Structure 12	172,500	760,000	932,500	171,900	315,400	487,300	600	444,600	445,200
Recreational Facilities	-	825,600	825,600	-	340,200	340,200	-	485,400	485,400
Floodwater Retarding Structures	1,309,900	-	1,309,900	969,900	-	969,900	340,000	-	340,000
GRAND TOTAL	1,482,400	1,585,600	3,068,000	1,141,800	655,600	1,797,400	340,600	930,000	1,270,600

1/ Price base - 1970.

August 1970

TABLE 2B - RECREATIONAL FACILITIES
ESTIMATED CONSTRUCTION COSTS

Clarks Fork-Bullocks Creek Watershed, South Carolina

1/
(Dollars)

Item	Number	Unit Cost	Total Construction Cost
1. Roads, paved	4.2 Miles 2/	20,000	84,000
2. Roads, unpaved	3.4 Miles 2/	15,000	51,000
3. Parking area, paved	5,700 Sq.Yd. 2/	2.15	12,255
4. Parking area, unpaved	5,000 Sq.Yd. 2/	0.50	2,500
5. Foot trail, paved	0.2 Miles 2/	4,000	800
6. Foot trail, unpaved	12.0 Miles 2/	3,000	36,000
7. Picnic Units - each consisting of 25 wood tables, 15 cast iron grills, 15 underground waste receptacle units, one picnic shelter, and one rest station	3 Each	20,000	60,000
8. Family Type Camping Units - each consisting of 25 site developments, 25 cast iron grills, 25 underground waste receptacle units, and one comfort station with showers	4 Each	25,000	100,000
9. Concrete Boat Ramp	1 Each	4,000	4,000
10. Timber Boat Dock (6' x 30')	1 Each	2,000	2,000
11. Timber Boat Dock (6' x 10')	2 Each	1,000	2,000
12. Primitive Camp Shelters	75 Each	800	60,000
13. Picnic Shelters (20' x 40')	3 Each	6,000	18,000
14. Pit Toilets	50 Each	600	30,000
15. Playground Equipment	Lump Sum		5,000
16. Water and Sewage Disposal Systems			80,000
17. Seeding and Landscaping			10,000
18. Signs and Gates			4,000
19. Electrical Distribution System			10,000
	Subtotal		571,555
	Contingencies (12%)		68,445
	TOTAL		640,000

1/ Price base - 1970.
2/ Estimated quantity, subject to minor variation at time of detailed design.

August 1970

TABLE 3 - STRUCTURAL DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY

Clarks Fork-Bullocks Creek Watershed, South Carolina

Item	Unit	Structure Number							Total
		2	12	14	15	18	19	56	
Class of Structure		b	b	a	b	a	b	a	
Drainage Area	Sq. Mi.	5.14	20.50	2.93	36.31 1/	3.93	16.12	8.60	93.53
Controlled	Sq. Mi.	-	-	-	44.69	-	-	-	
Curve No. (1-day) (AMC II)		73	67	70	75	73	76	72	
Tc	Hrs.	1.36	3.48	1.69	8.22	1.62	4.46	2.15	
Elevation Top of Dam	Ft.	638.5	678.5	596.5	491.0	503.5	547.0	478.0	
Elevation Crest Emergency Spillway	Ft.	632.5	672.0	591.5	485.0	499.0	540.0	473.0	
Elevation Crest Principal Spillway	Ft.	620.6	666.0	575.0	467.5	485.0	516.5	455.0	
Maximum Height of Dam	Ft.	41	81	32	34	36	39	36	
Volume of Fill	Cu. Yds.	61,000	363,600	50,000	182,500	34,400	99,700	108,200	899,400
Total Capacity	Ac. Ft.	1,360	17,300	510	9,200	860	4,000	1,890	35,120
Sediment, Submerged 1st 50 years	Ac. Ft.	185	175	51	272	74	136	131	1,024
Sediment, Submerged 2nd 50 years	Ac. Ft.	175	175	45	271	63	136	124	989
Sediment, Aerated	Ac. Ft.	27	14	7	74	14	72	49	257
Recreation	Ac. Ft.	-	12,936	-	-	-	-	-	12,936
Retarding	Ac. Ft.	973	4,000	407	8,583	709	3,656	1,586	19,914
Surface Area									
Sediment Pool	Acres	51	60	9	190	32	72	40	454
Recreation Pool	Acres	-	650	-	-	-	-	-	650
Retarding Pool	Acres	118	720	49	760	86	262	159	2,154
Principal Spillway									
Rainfall Volume (areal) (1 day)	In.	6.7	6.8	6.5	6.6	6.5	6.8	6.5	
Rainfall Volume (areal) (10 day)	In.	11.4	11.6	11.0	11.4	11.0	11.7	11.0	
Runoff Volume (10 day)	In.	5.46	4.41	4.56	5.76	5.14	6.31	4.85	
Capacity of Principal Spillway	cfs	111	311	104	1,065	59	255	102	
Frequency of Operation-Emer. Spwy.	% Chance	1.3	1.0	2.0	1.0	2.0	1.0	2.0	
Diameter of Conduit	In.	30	42	30	2/	24	42	30	
Emergency Spillway									
Rainfall Volume (ESH) (areal)	In.	8.4	7.9	6.9	8.0	6.9	8.1	6.9	
Runoff Volume (ESH)	In.	5.17	4.08	3.53	5.04	3.85	5.25	3.75	
Type		veg.	veg.	veg.	veg.	veg.	veg.	veg.	
Bottom Width	Ft.	160	200	90	400	110	250	200	
Velocity of Flow (V_e)	Ft./Sec.	6.8	4.7	5.2	3.5	3.7	6.1	4.6	
Slope of Exit Channel	Ft./Ft.	0.031	0.026	0.032	0.040	0.040	0.030	0.039	
Maximum Water Surface Elevation	Ft.	634.8	673.4	592.9	485.7	499.8	542.1	474.1	
Freeboard									
Rainfall Volume (FH) (areal)	In.	15.0	14.2	11.7	14.3	11.7	14.4	11.7	
Runoff Volume (FH)	In.	11.33	9.60	7.77	10.96	8.20	11.20	8.05	
Maximum Water Surface Elevation	Ft.	638.4	678.1	596.2	490.7	503.4	547.0	477.5	
Capacity Equivalents									
Sediment Volume	In.	1.41	0.33	0.66	0.32	0.72	0.40	0.66	
Retarding Volume	In.	3.55	3.66	2.60	4.43	3.38	4.25	3.46	
Recreation Volume	In.	-	11.83	-	-	-	-	-	

1/ Structure 15 is in series with Structures 2, 14, 12, and 19. The total drainage area above Structure 15 is 81.00 square miles.
2/ 6.5 ft. square box conduit.

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TABLE 4 - ANNUAL COST

Clarks Fork-Bullocks Creek Watershed, South Carolina

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost 2/	Operation and Maintenance Cost 3/	Total
Multiple Purpose Structure 12; Floodwater Retarding Structures 2, 14, 15, 18, 19 and 56; and Recreational Facilities	158,300	43,200	201,500
Project Administration	16,100		16,100
TOTAL	174,400	43,200	217,600

1/ Price base: Installation cost - 1970 prices, O&M - adjusted normalized prices.
2/ Amortized at 5 1/8 percent interest rate for 100 years.
3/ Includes $40,000 for operation and maintenance and replacement of recreational facilities.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Clarks Fork-Bullocks Creek Watershed, South Carolina

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	32,300	3,100	29,200
Other Agricultural	13,700	1,700	12,000
Nonagricultural	4,400	900	3,500
Subtotal	50,400	5,700	44,700
Sediment			
Overbank Deposition	14,900	2,800	12,100
Swamping	7,100	500	6,600
Subtotal	22,000	3,300	18,700
Indirect	7,000	1,000	6,000
TOTAL	79,400	10,000	69,400

1/ Price base - Adjusted normalized.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Clarks Fork-Bullocks Creek Watershed, South Carolina

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/						Average Annual Cost 2/	Benefit Cost Ratio
	Damage Reduction	More Intensive Land Use	Recreation	Incidental Recreation	Secondary	Total		
Multiple Purpose Structure 12, Floodwater Retarding Structures 2, 14, 15, 18, 19, and 56, and Recreational Facilities	3/ 64,700	43,000	345,000	26,300	56,000	535,000	201,500	2.7 to 1
Project Administration							16,100	
TOTAL	64,700	43,000	345,000	26,300	56,000	535,000	217,600	2.5 to 1

1/ Price base: Adjusted normalized.
2/ From Table 4.
3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $4,700 annually.

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TABLE 7 - CONSTRUCTION UNITS

Clarks Fork-Bullocks Creek Watershed, South Carolina

(Dollars) 1/

Measures in Construction Unit	Annual Benefit	Annual Cost
1. Structure 12 and Recreational Facilities	390,500	131,650
2. Structure 12, Recreational Facilities and Structure 14	411,250	138,200
3. Structure 2	11,150	7,450
4. Structure 19	15,700	11,150
5. Structure 12, Recreational Facilities and Structures 14, 2, 19, and 15	488,300	185,900
6. Structure 12, Recreational Facilities and Structures 14, 2, 19, 15, and 56	499,600	195,700

1/ Price base - Benefits - Adjusted Normalized
Installation Cost - 1970

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INVESTIGATIONS AND ANALYSES

Land Use and Treatment

Present land use was determined from Soil and Water Conservation District reports, surveys, and field studies. Estimates of future land use and treatment measures were made on the basis of the people involved, the land within the watershed, and present trends in the community. Needed land use adjustments based on soil capabilities were considered in arriving at the land treatment measures planned for the watershed.

A forestry survey showed ground cover, forest and hydrologic conditions and treatment needs. This survey, supporting data, and information from other agencies and forestry officials determined the amount of remedial measures needed. The effect of the proposed works of improvement on fire hazard and risk were analyzed. The measures recommended contribute to flood prevention and soil stabilization.

The costs of installing the land treatment measures were developed by the Soil Conservation Service, the South Carolina State Commission of Forestry, and the U.S. Forest Service. Technical assistance costs were based on the present costs of the going District program, the going Cooperative Forest Management Program, and the going Cooperative Forest Fire Control Program. Costs of installing land treatment measures were based on prices paid by landowners and operators in the locality. The amount of land treatment measures needed to meet treatment goals was based on a field survey of the watershed and adjusted for expected participation.

Structures

Vertical control for the structures was based upon mean sea level datum as established by U.S. Coast and Geodetic Survey and U.S. Geological Survey. Temporary bench marks were established throughout the watershed.

Topographic maps with five foot contour intervals were made of the reservoir area of each floodwater retarding structure. All these maps were made using low level aerial photography and the stereoplotter. These maps were used to develop stage-area and stage-storage curves and are adequate for final design.

Structures were designed in accordance with SCS Engineering Memorandum-27. Retarding storage for each structure was determined by a computer routing of the 10-day hydrograph for the principal spillway design storm. The emergency and freeboard hydrographs were also routed using the computer. The principal spillways and the emergency spillways were proportioned to determine the most economical structures.

A DAMCO drill rig was used in the investigation of Sites 2, 12, and 15.

Supplemental investigations of all sites were made with a hand auger. Packer tests for determination of permeability along fractures in tonalite were made at Site 12. At Site 2, eight holes were made to locate and classify borrow, five holes to determine rock excavation in the emergency spillway, and one hole was made in the flood plain to investigate foundation conditions. At Site 15, six holes were made to locate and classify borrow, nine holes to define foundation conditions, and four holes to classify spillway materials. In addition, at Site 15, permeability tests were conducted in the three principal sedimentary horizons and blow counts were taken in the underlying saprolite.

The conclusions drawn from the investigations are: (1) no seepage problems; (2) non-yielding foundations at Sites 12 and 18; (3) rock excavation in the emergency spillway at Site 2 and in the cut-off trenches at Sites 2, 56, and 18; and (4) sufficient borrow is available at all sites although some borrow areas will be located above the top of dam elevations.

Estimates of sediment storage requirements were made in accordance with SCS approved procedures. The sediment storage was computed using submerged unit weights of 65 to 75 pounds per cubic foot and aerated weights of 85 to 95 pounds per cubic foot. Aerated unit weights were considered similar to the dry unit weights of upland samples. Submerged unit weights were estimated. The amount of aerated sediment for the structures varied from 5 to 35 percent. Estimates were based on texture of sediment, delivery ratios, shape and size of reservoirs, and entry slopes.

Recreational Facilities

The plans for the recreational facilities were developed jointly by the South Carolina Department of Parks, Recreation and Tourism and the Soil Conservation Service. The Department of Parks, Recreation and Tourism is a relatively new state agency and this proposed development represents one of their first efforts as a watershed sponsor.

The recreational facilities are based on standard designs and layouts used by the South Carolina Department of Parks, Recreation and Tourism. Sanitary facilities similar to those proposed have been approved by the State Health Department in other parks.

Additional Storage Potential

Structures 15 and 19 have excellent potential for additional beneficial storage. Attempts have been made throughout the planning phase to inform sponsors and other groups of the additional storage available. However, no sponsor with sufficient funds was available. If a sponsor is found prior to construction of these structures, it would be possible to supplement this Work Plan to include the additional storage.

The following data indicates the potential water supply which could be added to these structures:

Structure No.	Additional Beneficial Storage That Could Be Provided	Expected Constant Demand	Cost of Storage in Work Plan Structure
	Ac. Ft.	MGD	Dollars/Ac.Ft.
15	650	4.5	65
	2,350	9.4	
	5,000	14.7	
19	1,070	3.0	58
	1,710	4.0	
	2,460	5.0	

Hydraulic and Hydrology

An analysis of the watershed was made using procedures in the National Engineering Handbook, Section 4, Supplement A. This analysis was used to develop physical data for the economic evaluation and design of proposed works of improvement.

The partial duration series of rainfall was developed using rainfall data from the U.S. Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States". Rainfall data were used since no USGS stream gage is located within the watershed.

The weighted average curve numbers of the watershed were determined by applying information obtained from local observation, the U.S. Forest Service, District Conservationist, and Soil Scientist to the procedures outlined in the National Engineering Handbook, Section 4, Supplement A. Runoff was determined by applying rainfall amounts to the weighted average curve number.

Design runoff curve numbers for the structures were developed by evaluation of the condition of the watershed above each site.

The principal spillway, emergency spillway, and freeboard hydrographs were developed in accordance with procedures outlined in Chapter 21 of the National Engineering Handbook, Section 4, Supplement A.

Water surface profile computations, using the I.B.M. 1130 Computer, were used to determine stage-discharge relationships for 34 representative cross-sections. Stage-area flooded tables, by depth increments for 18 of these cross-sections were also calculated by this computer.

The 1, 10, 33, 50, 100 and 250 percent chance storms were routed through 34 representative cross-sections using the Convex method of routing by the I.B.M. 1130 Computer.

Reservoir operation studies were made on multiple purpose Structure 12. These studies were made using the I.B.M. 1130 Computer using the following data:

1. Stage-storage and stage-area curves were developed for the structure

2. The most critical drought period on record (1953 through 1957) was selected for study

3. The U.S. Geological Survey stream gage records on Fairforest Creek near Union, South Carolina, were used to obtain monthly inflow in inches

4. The following records were used to compute the net evaporation from the reservoir surface:

   a. U.S. Weather Bureau Class A pan records at Clarks Hill, South Carolina

   b. U.S. Weather Bureau Standard rain gage at Gaffney, South Carolina

5. Minimum low flow release of 5 cfs (or inflow, if less)

This study showed that there would be a decrease of only 29 surface acres during the driest period of record.

Geology

A bed load transport equation was used to check channel bed stability below Structures 2 and 15. All variables used in the equation, with the exception of median grain size (d_{50}) of upland and streambed materials, were available from existing hydraulic, engineering, and geologic data. Representative streambed and upland samples were collected for the determination of (d_{50}) grain sizes. The bed load equation was calculated for both "future with project" and "future without project" conditions. Present field conditions are assumed to be comparable to "future without".

Present analysis of Buckhorn Creek below Structure 2 to its confluence with Bullocks shows an aggrading condition. This condition is created by entrained sediment. The existing transport capacity of the creek under present sediment yield conditions would eventually allow the creek to adjust to equilibrium. Installation of the project will speed up this adjustment.

At present, Bullocks Creek from Structure 15 to the Broad River is nearly in equilibrium. One exception is a two mile reach between the Mitchell Branch and Loves Creek confluences. An aggrading condition exists in this reach. Without the project, this condition will continue. Installation of the project will bring about a nearly equilibrium condition for the entire stream reach.

An estimate of average annual sediment concentration at the outlet of the watershed was made following procedures outlined in Chapter VIIA of the "Guide to Sedimentation Investigations", prepared by the E&WP Unit of the South Regional Technical Service Center, revised July 1968.

A study of physical damages to the flood plains of the watershed was conducted by surface inspection of flood plain reaches, followed by subsurface investigations. The extent and degree of swamping were noted. Damages were summarized by evaluation reaches and adjusted for recoverability of productive capacity. Estimates of recoverability were developed from field studies and interviews with landowners. Calculations of reduction in sediment yield by evaluation reaches were made to determine reduction due to structural and land treatment measures.

Fish and Wildlife

The U.S. Bureau of Sport Fisheries and Wildlife, in cooperation with the South Carolina Wildlife Resources Department and the North Carolina Wildlife Resources Commission made a reconnaissance study of the watershed to determine the present fish and wildlife resources and the effect of the project on these resources.

Economics

Methods used in making the economic investigations and analyses followed those approved by the Soil Conservation Service in benefit-cost evaluation of land and water resource projects. Basic data were obtained from landowners, agricultural workers, experiment stations, county officials, state highway department personnel, university and USDA publications, and officials of the South Carolina Department of Parks, Recreation and Tourism.

Cost sharing for the purchase price of land for Structure 12 and the recreational development area was determined as follows:

Minimum taking line for reservoir	1,241 acres
Twice the area of recreation pool	1,300 acres
Total	2,541 acres
Amount presently owned by PR&T	1,470 acres
Maximum available for 50-50 cost sharing	1,071 acres

The total area selected for purchase was 550 acres, all of which is

eligible for 50-50 cost sharing.

Adjusted normalized prices were used in all benefit computations, as well as for operation and maintenance costs. These prices were based on data approved by the Interdepartmental Staff Committee, Water Resources Council, on April 20, 1966. Present (1970) prices were used for estimating installation costs. The costs of all structural measures were amortized over a 100-year period using 5 1/8 percent interest rate.

Floodwater damage reduction benefits were computed for each reach using the ECON-2 computer program.

Restoration of former productivity benefits of $11,200 annually were estimated on the basis of increases in net income due to reduction in flood hazards. Associated costs and increased damages due to higher damageable values with the project were deducted from gross benefits. Special attention was given in the evaluation procedure to avoid the possibility of double counting benefits.

Indirect damages were estimated to be 10 percent of direct floodwater damages to cropland and pasture land and 20 percent of nonagricultural damages.

Sediment damage reduction benefits were estimated on the basis of increased net income which is expected to accrue as a result of recovery of land damage. Consideration was given to the degree of recovery that can be expected and the probable time required for recovery.

Benefits from more intensive use were calculated on the basis of expected increases in crop yields. The increase in yield will result from increased use of fertilizers and improved managerial practices made possible by reducing the flood hazard. Future flood damages to these higher damageable values were deducted from gross benefits. The planned land use is within the capability of the flood plain soils.

Recreation benefits were estimated by a representative of the South Carolina Department of Parks, Recreation and Tourism. The expected use was based on the use of Kings Mountain State Park and the capacity of the planned recreational facilities. A value of $1.50 per visitor day was used. These benefits were checked for reasonableness and to determine if they exceeded costs.

Benefits from incidental recreation use were claimed for all structures, except Structure 12. A value of $1.00 per visitor day was estimated to accrue at the rate of 75 visitor days per surface acre per year. Non-project associated costs to allow for construction and maintenance of proper sanitation measures, access roads, liability insurance, and other necessary recreational facilities were deducted. An allowance was also made for the accumulation of sediment in these structures.

The value of local secondary benefits stemming from the project were estimated to be 10 percent of the direct primary benefits. Indirect benefits were excluded when computing secondary benefits. The value of local secondary benefits induced by the project were estimated to be 10 percent of the increased costs that producers will incur in connection with increased or sustained production.

Secondary benefits from a national viewpoint were not used in the project evaluation.